CLAIMS

WHAT IS CLAIMED IS:

1. A back-illuminated image sensor comprising:

a semiconductor base of a first conductive type;

a plurality of charge accumulating units of a second conductive type different from said first conductive type, formed on a second-plane side which is the backside of a first plane of said semiconductor base, said charge accumulating units which accumulate, on a pixel-by-pixel basis, signal charges generated by an energy ray incident from the second-plane side;

a charge transfer unit formed on the first-plane side of said semiconductor base facing said charge accumulating units, the charge transfer unit which transfers said signal charges to be read;

a charge transport unit which transports said signal charges accumulated in said charge accumulating units to said charge transfer unit; and

a depletion prevention layer formed closer to said second-plane side than said charge accumulating units, the depletion prevention layer which prevents a depletion region around said charge accumulating units from reaching said second plane.

2. An image sensor according to claim 1, wherein said depletion prevention layer is of said first conductive type.

3. An image sensor according to claim 2, wherein said depletion prevention layer has impurity distribution that allows said energy ray to pass through and impurity concentration rate that prevents said depletion region from reaching said second plane.

4. An image sensor according to claim 2, wherein said charge accumulating units are fully depleted at completion of charge transportation.

5. A back-illuminated image sensor comprising:

a semiconductor base of a first conductive type;

a plurality of charge accumulating units of a second conductive type different from said first conductive type, formed on a second-plane side which is the backside of a first plane of said semiconductor base, said charge accumulating units which accumulate, on a pixel-by-pixel basis, signal charges generated by an energy ray incident from the second-plane side;

a charge transfer unit formed on the first-plane side of said semiconductor base facing said charge accumulating units, the charge transfer unit which transfers said signal charges to be

read;

a charge transport unit which transports said signal charges accumulated in said charge accumulating units to said charge transfer unit; and

an invalid charge discharging unit which drives said charge transfer unit to discharge an invalid charge while said charge accumulating units accumulate said signal charges.

6. A back-illuminated image sensor comprising:

a semiconductor base of a first conductive type;

a plurality of charge accumulating units of a second conductive type different from said first conductive type, formed on a second-plane side which is the backside of a first plane of said semiconductor base, said charge accumulating units which accumulate, on a pixel-by-pixel basis, signal charges generated by an energy ray incident from the second-plane side;

a charge transfer unit formed on the first-plane side of said semiconductor base facing said charge accumulating units, the charge transfer unit which transfers said signal charges to be read;

a charge transport unit which transports said signal charges accumulated in said charge accumulating units to said charge transfer unit; and

a dark current suppressing unit which approximates a potential of the first-plane side of said charge transfer unit to a substrate potential to suppress dark current flowing in from said first-plane side, at least during a predetermined period while said charge accumulating units accumulate said signal charges.

7. A back-illuminated image sensor comprising:

a semiconductor base of a first conductive type;

a plurality of charge accumulating units of a second conductive type different from said first conductive type, formed on a second-plane side which is the backside of a first plane of said semiconductor base, said charge accumulating units which accumulate, on a pixel-by-pixel basis, signal charges generated by an energy ray incident from the second-plane side;

a charge transfer unit formed on the first-plane side of said semiconductor base facing said charge accumulating units, the charge transfer unit which transfers said signal charges to be read;

a charge transport unit which transports said signal charges accumulated in said charge accumulating units to said charge transfer unit; and

an excessive charge discharging unit which overflows an excessive charge into said charge transfer unit and drives said charge transfer unit to discharge said excessive charge, said excessive charge occurring due to exceeding a saturation charge amount of said charge accumulating units.

8. An image sensor comprising:

a semiconductor base of a first conductive type;

a plurality of charge accumulating units of a second conductive type different from said first conductive type, formed on a second-plane side which is the backside of a first plane of said semiconductor base, said charge accumulating units which accumulate, on a pixel-by-pixel basis, signal charges generated by an energy ray incident from the second-plane side;

a charge transfer unit formed on the first-plane side of said semiconductor base facing said charge accumulating units, the charge transfer unit which transfers said signal charges to be read; and

a charge transport unit which transports said signal charges accumulated in said charge accumulating units to said charge transfer unit, and wherein

said charge transport unit applies a voltage to said semiconductor base to control said charge accumulating units in potential, whereby transports said signal charges in said charge accumulating units to said charge transfer unit.

9. An image sensor according to claim 8, wherein said semiconductor base has a well structure surrounded by a semiconductor region of said second conductive type.

10. A method of fabricating a back-illuminated image sensor, comprising:

a thinning step of thinning a semiconductor base of a first conductive type;

an accumulating unit forming step of forming, on one plane side of said semiconductor base thinned, a plurality of charge accumulating units of a second conductive type different from said first conductive type; and

a layer forming step of forming, on the one plane side of said semiconductor base thinned, a depletion prevention layer of said first conductive type for preventing a surface deletion resulting from said charge accumulating units.

11. A back-illuminated image sensor comprising:

a semiconductor base of a first conductive type;

a plurality of charge accumulating units of a second conductive type different from said

first conductive type, formed on a second-plane side which is the backside of a first plane of said semiconductor base, said charge accumulating units which accumulate, on a pixel-by-pixel basis, signal charges generated by an energy ray incident from the second-plane side;

a charge transfer unit formed on the first-plane side of said semiconductor base facing said charge accumulating units, the charge transfer unit which transfers said signal charges to be read;

a charge transport unit which transports said signal charges accumulated in said charge accumulating units to said charge transfer unit; and

a barrier region provided on at least a part of transport paths of said signal charges formed between said charge accumulating units and said charge transfer unit, the barrier region which creates a peak of a potential barrier to block progress of said signal charges when no charge is to be transported and ensures full transportation of said signal charges by eliminating the peak of said potential barrier by said charge transport unit when a charge is transported.

12. An image sensor according to claim 11, wherein said barrier region is formed by introducing impurities of said first conductive type into said semiconductor base.

13. An image sensor according to claim 12, wherein a concentration rate of said impurities introduced into said barrier region is set higher than a concentration rate of said semiconductor base.

14. An image sensor according to claim 11, wherein said barrier region is provided in contact with said charge transfer unit.

15. An image sensor according to claim 11, wherein at the time of no charge transportation, said potential barrier in said barrier region is set lower than a potential barrier between adjoining charge accumulating units according to the view points of the polarity of said signal charges.

16. A method of fabricating a back-illuminated image sensor having a barrier region, comprising the steps of:

forming an epitaxial layer of a first conductive type on a first-plane side of a substrate;

introducing impurities of said first conductive type into said epitaxial layer from said first-plane side to form a barrier region;

introducing impurities of a second conductive type different from said first conductive type into said epitaxial layer so as to form a charge transfer unit in said first-plane side at a region located shallower than said barrier region as seen from said first-plane side;

removing at least a part of said substrate to thin a second-plane side opposite of said first-plane side; and

introducing impurities of said second conductive type from said second-plane side so as to form charge accumulating units in pixel-by-pixel arrangement.

17. A method of fabricating a back-illuminated image sensor having a barrier region, comprising the steps of:

forming an epitaxial layer of a first conductive type on a first-plane side of a substrate;

introducing impurities of said first conductive type into said epitaxial layer from said first-plane side to form a barrier region;

introducing impurities of said first conductive type into the first-plane side of said first epitaxial layer at a region located shallower than said charge accumulating units as seen from said first-plane side, thereby forming a barrier region;

forming a second epitaxial layer of said first conductive type on the first-plane side of said first epitaxial layer;

introducing impurities of said second conductive type into the first-plane side of said second epitaxial layer to form a charge transfer unit; and

removing at least a part of said substrate to thin a second-plane side opposite of said first-plane side.

18. A method of fabricating a back-illuminated image sensor having a barrier region, comprising the steps of:

forming a first epitaxial layer of a first conductive type on a first-plane side of a substrate;

introducing impurities of a second conductive type different from said first conductive type into said first epitaxial layer from the first-plane side so as to form charge accumulating units in pixel-by-pixel arrangement;

forming a second epitaxial layer of said first conductive type on the first-plane side of said first epitaxial layer;

introducing impurities of said first conductive type into the first-plane side of said second epitaxial layer so as to form a barrier region;

introducing impurities of said second conductive type into the first-plane side of said second epitaxial layer at a region located shallower than said charge accumulating units as seen

from the first-plane side, thereby forming a charge transfer unit; and

removing at least a part of said substrate to thin a second-plane side opposite of said first-plane side.

19. A back-illuminated image sensor comprising:

a semiconductor base of a first conductive type;

a plurality of charge accumulating units of a second conductive type different from said first conductive type, formed on a second-plane side which is the backside of a first plane of said semiconductor base, said charge accumulating units which accumulate, on a pixel-to-pixel basis, signal charges generated by an energy ray incident from the second-plane side;

a charge transfer channel formed on the first-plane side of said semiconductor base facing said charge accumulating units, the charge transfer channel which transfers said signal charges; and

transfer electrodes which apply a transfer voltage to said charge transfer channel, and wherein

said transfer electrodes are provided in a charge transfer direction of said charge transfer channel, in proportion of substantially two or less said transfer electrodes per one said charge accumulating unit.

20. An image sensor according to claim 19, wherein said transfer electrodes are periodically provided in a charge transfer direction of said charge transfer channel, in proportion of substantially two said electrodes per one said charge accumulating unit.

21. An image sensor according to claim 19, comprising:

a split transport unit which transports signal charges from said charge accumulating units to said charge transfer channel, said transporting being performed at phase intervals of said transfer electrodes, and the split transport unit which transports one screenful of signal charges at a plurality of times while shifting the phases of positions where signal charges are to be transported; and

a split transfer unit which drives said transfer electrodes in multi-phase, each time said split transport unit transports signal charges to said charge transfer channel, and the split transfer unit which reads out one screenful of signal charges at a plurality of times.

22. An image sensor according to claim 20, wherein said charge transfer channel has variations in impurity concentration in every interval of said transfer electrodes, and said transfer

electrodes are driven in two phases to progressively transfer signal charges.

23. An alignment device comprising:

an image sensor according to claim 1;

a position detecting unit which is electrically connected to said image sensor and detects positional information of the object according to the image sensed of an object or a mark formed on the object by using said image sensor; and

a position controlling unit which is electrically connected to said position detecting unit and performs a positioning operation of said object according to said positional information.

24. An alignment device comprising:

an image sensor according to claim 5;

a position detecting unit which is electrically connected to said image sensor and detects positional information of the object according to the image sensed of an object or a mark formed on the object by using said image sensor; and

a position controlling unit which is electrically connected to said positioning detecting unit and performs a positioning operation of said object according to said positional information.

25. An alignment device comprising:

an image sensor according to claim 6;

a position detecting unit which is electrically connected to said mage sensor and detects positional information of the object according to the image sensed of an object or a mark formed on the object by using said image sensor; and

a position controlling unit which is electrically connected to said position detecting unit and performs a positioning operation of said object according to said positional information.

26. An alignment device comprising:

an image sensor according to claim 7;

a position detecting unit which is electrically connected to said image sensor and detects positional information of the object according to the image sensed of an object or a mark formed on the object by using said image sensor; and

a position controlling unit which is electrically connected to said position detecting unit and performs a positioning operation of said object according to said positional information.

27. An alignment device comprising:

an image sensor according to claim 8;

a position detecting unit which is electrically connected to said image sensor and detects positional information of the object according to the image sensed of an object or a mark formed on the object by using said image sensor; and

a position controlling unit which is electrically connected to said position detecting unit and performs a positioning operation of said object according to said positional information.

28. An exposure apparatus comprising:

an image sensor according to claim 1;

a position detecting unit which is electrically connected to said image sensor and detects positional information of the object according to the image sensed of an object or a mark formed on the object by using said image sensor; and

a position controlling unit which is electrically connected to said position detecting unit and performs a positioning operation of said object according to said positional information; and

an exposure unit which exposes said substrate positioned by said position controlling unit with a predetermined pattern.

29. An exposure apparatus comprising:

an image sensor according to claim 5;

a position detecting unit which is electrically connected to said image sensor and detects positional information of the object according to the image sensed of an object or a mark formed on the object by using said image sensor; and

a position controlling unit which is electrically connected to said position detecting unit and performs a positioning operation of said object according to said positional information; and

an exposure unit which exposes said substrate positioned by said position controlling unit with a predetermined pattern.

30. An exposure apparatus comprising:

an image sensor according to claim 6;

a position detecting unit which is electrically connected to said image sensor and detects positional information of the object according to the image sensed of an object or a mark formed on the object by using said image sensor; and

a position controlling unit which is electrically connected to said position detecting unit and performs a positioning operation of said object according to said positional information; and

an exposure unit which exposes said substrate positioned by said position controlling

unit with a predetermined pattern.

31. An exposure apparatus comprising:

an image sensor according to claim 7;

a position detecting unit which is electrically connected to said image sensor and detects positional information of the object according to the image sensed of an object or a mark formed on the object by using said image sensor; and

a position controlling unit which performs a positioning operation of said object according to said positional information; and

an exposure unit which exposes said substrate positioned by said position controlling unit with a predetermined pattern.

32. An exposure apparatus comprising:

an image sensor according to claim 8;

a position detecting unit which is electrically connected to said image sensor and detects positional information of the object according to the image sensed of an object or a mark formed on the object by using said image sensor; and

a position controlling unit which performs a positioning operation of said object according to said positional information; and

an exposure unit which exposes said substrate positioned by said position controlling unit with a predetermined pattern.

33. An aberration measuring device comprising:

an image sensor according to claim 1;

an aberration measuring optical system which emits a pencil of light for aberration measurement to an optical system to be measured;

a condenser lens which condenses said pencil of light passing through said optical system to be measured, onto an imaging plane of said image sensor;

a position detecting unit which is electrically connected to said image sensor and detects positional information of said pencil of light condensed on said imaging plane; and

an operation unit which is electrically connected to said position detecting unit and determines an aberration of said optical system to be measured, according to a detection result from said position detecting unit.

34. An aberration measuring device comprising:

an image sensor according to claim 5;

an aberration measuring optical system which emits a pencil of light for aberration measurement to an optical system to be measured;

a condenser lens which condenses said pencil of light to pass through said optical system to be measured, onto an imaging plane of said image sensor;

a position detecting unit which is electrically connected to said image sensor and detects positional information of said pencil of light condensed on said imaging plane; and

an operation unit which is electrically connected to said position detecting unit and determines an aberration of said optical system to be measured, according to a detection result from said position detecting unit.

35. An aberration measuring device comprising:

an image sensor according to claim 6;

an aberration measuring optical system which emits a pencil of light for aberration measurement to an optical system to be measured;

a condenser lens which condenses said pencil of light to pass through said optical system to be measured, onto an imaging plane of said image sensor;

a position detecting unit which is electrically connected to said image sensor and detects positional information of said pencil of light condensed on said imaging plane; and

an operation unit which is electrically connected to said position detecting unit and determines an aberration of said optical system to be measured, according to a detection result from said position detecting unit.

36. An aberration measuring device comprising:

an image sensor according to claim 7;

an aberration measuring optical system which emits a pencil of light for aberration measurement to an optical system to be measured;

a condenser lens which condenses said pencil of light to pass through said optical system to be measured, onto an imaging plane of said image sensor;

a position detecting unit which is electrically connected to said image sensor and detects positional information of said pencil of light condensed on said imaging plane; and

an operation unit which is electrically connected to said position detecting unit and determines an aberration of said optical system to be measured, according to a detection result

from said position detecting unit.

37. An aberration measuring device comprising:

an image sensor according to claim 8;

an aberration measuring optical system which emits a pencil of light for aberration measurement to an optical system to be measured;

a condenser lens which condenses said pencil of light to pass through said optical system to be measured, onto an imaging plane of said image sensor;

a position detecting unit which is electrically connected to said image sensor and detects positional information of said pencil of light condensed on said imaging plane; and

an operation unit which is electrically connected to said position detecting unit and determines an aberration of said optical system to be measured, according to a detection result from said position detecting unit.

38. An exposure apparatus comprising:

an image sensor according to claim 1;

an exposure unit which projects an exposure pattern onto a substrate to be exposed, through a projection optical system;

an aberration measuring optical system which emits a pencil of light for aberration measurement to said projection optical system;

a condenser lens which condenses said pencil of light to pass through said projection optical system onto an imaging plane of said image sensor;

a position detecting unit which is electrically connected to said image sensor and detects positional information of said pencil of light condensed on said imaging plane; and

an operation unit which is electrically connected to said position detecting unit and determines an aberration of said optical system to be measured, according to a detection result from said position detecting unit.

39. An exposure apparatus comprising:

an image sensor according to claim 5;

an exposure unit which projects an exposure pattern onto a substrate to be exposed, through a projection optical system;

an aberration measuring optical system which emits a pencil of light for aberration measurement to said projection optical system;

a condenser lens which condenses said pencil of light to pass through said projection optical system onto an imaging plane of said image sensor;

a position detecting unit which is electrically connected to said image sensor and detects positional information of said pencil of light condensed on said imaging plane; and

an operation unit which is connected to said position detecting unit and determines an aberration of said optical system to be measured, according to a detection result from said position detecting unit.

40. An exposure apparatus comprising:

an image sensor according to claim 6;

an exposure unit which projects an exposure pattern onto a substrate to be exposed, through a projection optical system;

an aberration measuring optical system which emits a pencil of light for aberration measurement to said projection optical system;

a condenser lens which condenses said pencil of light to pass through said projection optical system onto an imaging plane of said image sensor;

a position detecting unit which is electrically connected to said image sensor and detects positional information of said pencil of light condensed on said imaging plane; and

an operation unit which is electrically connected to said position detecting unit and determines an aberration of said optical system to be measured, according to a detection result from said position detecting unit.

41. An exposure apparatus comprising:

an exposure unit which projects an exposure pattern onto a substrate to be exposed, through a projection optical system;

an aberration measuring optical system which emits a pencil of light for aberration measurement to said projection optical system;

a condenser lens which condenses said pencil of light to pass through said projection optical system onto an imaging plane of said image sensor;

a position detecting unit which is electrically connected to said image sensor and detects positional information of said pencil of light condensed on said imaging plane; and

an operation unit which is electrically connected to said position detecting unit and determines an aberration of said optical system to be measured, according to a detection result

from said position detecting unit.

42. An exposure apparatus comprising:

an image sensor according to claim 8;

an exposure unit which projects an exposure pattern onto a substrate to be exposed, through a projection optical system;

an aberration measuring optical system which emits a pencil of light for aberration measurement to said projection optical system;

a condenser lens which condenses said pencil of light to pass through said projection optical system onto an imaging plane of said image sensor;

a position detecting unit which is electrically connected to said image sensor and detects positional information of said pencil of light condensed on said imaging plane; and

an operation unit which is electrically connected to said position detecting unit and determines an aberration of said optical system to be measured, according to a detection result from said position detecting unit.

43. A measuring device comprising:

an image sensor according to claim 11; and

a measuring unit which is electrically connected to said image sensor and performs at least one of aberration measurement and position measurement of a subject, according to an image of the subject sensed by said image sensor.

44. A measuring device comprising:

an image sensor according to claim 19; and

a measuring unit which is electrically connected to said image sensor and performs at least one of aberration measurement and position measurement of a subject, according to an image of said subject sensed by said image sensor.

45. An exposure apparatus comprising:

an image sensor according to claim 11;

an exposure unit which projects an exposure pattern onto an object to be exposed;

a measuring unit which is electrically connected to said image sensor and performs at least one of aberration measurement and position measurement of a subject, according to an image of said subject sensed by said image sensor; and

a control unit which is electrically connected to said measuring unit and performs at

least one of aberration correction on said exposure unit and positional control of an exposure position, according to a measurement output from said measuring unit.

46. An exposure apparatus comprising:

an image sensor according to claim 19;

an exposure unit which projects an exposure pattern onto an object to be exposed;

a measuring unit which is electrically connected to said image sensor and performs at least one of aberration measurement and position measurement of a subject, according to an image of said subject sensed by said image sensor; and

a control unit which is electrically connected to said measuring unit and performs at least one of aberration correction on said exposure unit and positional control of an exposure position, according to a measurement output from said measuring unit.

47. A method of fabricating a device comprising:

a mark forming step of forming a first alignment mark on a first-plane side of a substrate;

a base forming step of forming a base portion of a device on the first-plane side of said substrate;

a first-plane side processing step of forming a first structure on the first-plane side of said base portion by using, as a reference, one of a projection and a depression which appears on the first-plane side of said base portion in the process of forming said base portion;

a removing step of removing said substrate from a second-plane side of said base portion opposite to said first-plane side; and

a second-plane side processing step of forming a second structure on the second-plane side of said base portion by using , as a reference, a second alignment mark which appears on the second-plane side of said base portion in the process of removing said substrate, said second structure being different from said first structure.

48. A method of fabricating a device comprising:

a base forming step of forming a base portion of a device on a first-plane side of a substrate;

a to-be removed region forming step of forming, in said base portion, a to-be-removed region which reaches said substrate and is selectively removable;

a mark forming step of forming a first alignment mark on the first-plane side in said to-

be-removed region;

a first-plane side processing step of forming a first structure on the first-plane side of said base portion by using said first alignment mark as a reference;

a layer forming step of forming a layer to cover at least said first alignment mark;

a removing step of removing said substrate and said to-be-removed region from a second-plane side of said base portion which is opposite of said first-plane side; and

a second-plane side processing step of forming a second structure on the second-plane side of said base portion by using, as a reference, a second alignment mark which appears on the second-plane side in the process of removing said substrate, said second structure being different from said first structure.

49. A method of fabricating a device comprising:

a mark forming step of forming a first alignment mark on a first-plane side of a substrate;

a base forming step of forming a base portion of a device on the first-plane side of said substrate;

a step of forming a first structure on the first-plane side of said base portion by using, as a reference, one of a projection and a depression which appears on the first-plane side of said base portion in the process of forming said base portion;

a processing step of forming a predetermined structure on the first-plane side of said base portion by using , as a reference, a second alignment mark which appears on the second-plane side of said base portion in the process of removing said substrate, said second structure being different from said first structure.

50. A method of fabricating a device comprising:

a mark forming step of forming a first alignment mark being one of a projection and a depression on a first-plane side of a substrate;

a base forming step of forming a base portion of a device on the first-plane side of said substrate;

a removing step of removing said substrate from a second-plane side of said base portion which is opposite of the first-plane side, so that a second alignment mark appears on the second-plane side of said base portion; and

a processing step of forming a predetermined structure on the second-plane side of said

base portion by using said second alignment mark as a reference.

51. A method of fabricating a device comprising:

a base forming step of forming a base portion of a device on a first-plane side of a substrate, where a first alignment mark is formed;

a to-be-removed region forming step of forming a to-be-removed region in said base portion, said to-be-removed region reaching said substrate and being selectively removable;

a layer forming step of forming a layer to cover at least said first alignment mark;

a removing step of removing said substrate and said to-be-removed region from a second-plane side of said base portion which is opposite of the first-plane side, so that a second alignment mark appears on the second-plane side of said base portion; and

a processing step of forming a predetermined structure on the second-plane side of said base portion by using said second alignment mark as a reference.

52. A method of fabricating a device comprising:

a base forming step of forming a base portion of a device on a first-plane side of a substrate;

a to-be-opened region forming step of forming a to-be-opened region in a to-be-opened area of said base portion during or after the process of forming said base portion, said to-be-opened region reaching said substrate and being selectively removable; and

a removing step of removing said substrate and said to-be-opened region from a second-plane side of said base portion, which is opposite of the first-plane side, so that an opening hole (a trace of said removed to-be-opened region) appears on the second-plane side of said base portion.

53. A method of fabricating a device according to any one of claims 47, 49, 50, and 51, wherein said substrate includes antimony (Sb).

54. A method of fabricating a device according to one of claims 48 and 51, wherein said to-be-removed region is made of material including antimony (Sb) in said to-be-removed region forming step.

55. A method of fabricating a device according to claim 47, wherein said mark forming step further comprises the steps of:

forming one of a depression and a projection on said substrate; and

forming one of a silicon oxide film and a silicon nitride film on a surface of one of said depression and projection.

56. A method of fabricating a device according to claim 47, further comprising:

a through-hole forming step of forming a through-hole in said base portion by using said second alignment mark after forming said second structure in said second-plane side processing step; and

a wiring step of forming a wiring portion which electrically connects said first structure to said second structure via said through-hole.

57. A method of fabricating a device according to claim 47, wherein said removing step further comprises the steps of:

polishing said substrate by chemical mechanical polishing so that said substrate has a thickness thinner than or equal to a fixed thickness; and

wet-etching said polished substrate.

58. A method of fabricating a device according to claim 47, wherein said base forming step further comprises the steps of:

laminating a polysilicon layer on said substrate; and

forming a base portion by single-crystallizing said laminated polysilicon layer.

59. A semiconductor device having an epitaxial layer formed on said support substrate comprising:

a first structure formed on a first-plane side of said epitaxial layer, said first plane being on a side of said support substrate; and

a second structure formed on a second-plane side of said epitaxial layer, said second plane being on the opposite side of said support substrate.

60. A semiconductor device according to claim 59, wherein said first structure and said second structure are connected to each other via a through-hole formed in said epitaxial layer.

61. A semiconductor device according to claim 59, wherein alignment marks are formed at predetermined positions on said epitaxial layer, the alignment marks being a depression on the first-plane side and a projection on the second-plane side or being a projection on the first-plane side and a depression on the second-plane side.